CLAIMS

1. An adsorber vessel for use in the adsorption of a component from a gas and subsequent regeneration by thermally induced desorption of said component, said vessel comprising an inlet for regeneration gas having an inlet nozzle containing at least one heater element, and an outlet for regeneration gas, said inlet and outlet for regeneration gas being separated by a flow path including a flow chamber containing a body of adsorbent, and wherein said body of adsorbent has a first end which is adjacent said inlet for regeneration gas and a second end which is remote from said inlet for regeneration gas, and the or each heater element is located so as not to penetrate through said first end of the body of adsorbent.

2. A vessel as claimed in Claim 1, wherein the distance from said at least one heater element to the adsorbent in the vessel is no more than 2.5 metres.

3. A vessel as claimed in Claim 2, wherein said distance is no more than 1.5 metres.

4. Apparatus for use in the removal of at least one component from a gas mixture by a swing adsorption process having an adsorbent regeneration phase, said apparatus comprising:

an adsorber vessel comprising an inlet for said gas mixture and an outlet for purified gas separated by a flow path including a flow chamber containing a body of adsorbent, and having an inlet for regeneration gas and an outlet for regeneration gas separated by a flow path including said flow chamber, said inlet for said gas mixture and said outlet for purified gas optionally constituting also said outlet for regeneration gas and said inlet for regeneration gas, said inlet for regeneration gas having an inlet nozzle containing at least one heater element, wherein said body of adsorbent has a first end which is adjacent said inlet for regeneration gas and a second end which is remote from said inlet for regeneration gas, and the or each heater element is located so as not to penetrate through said first end of the body of adsorbent,

a source of gas mixture to be separated connected to said inlet for gas mixture,

a source of regeneration gas connected to said inlet for regeneration gas, and control means for operating a cycle of adsorption and regeneration in which:

gas mixture is passed over said adsorbent in a first flow direction and is purified by the adsorption of at least one component and flow of the gas mixture over the adsorbent is stopped,

regeneration gas is passed over the adsorbent in the same or in an opposite flow direction, said regeneration gas being heated by said heater element, and

flow of the regeneration gas is stopped and flow of the gas mixture is resumed.

5. Apparatus as claimed in Claim 4, comprising two or more said adsorption vessels arranged in parallel for operation such that at least one said vessel is online for adsorption whilst at least one other said vessel is being regenerated.

6. Apparatus as claimed in Claim 4, wherein said control means operates said apparatus to perform TSA, TEPSA, or TPSA.

7. A swing adsorption method of removing at least one component from a gas mixture, said method comprising:

in an adsorption phase, passing said gas mixture in a first direction into an adsorber vessel comprising an inlet for said gas mixture and an outlet for purified gas separated by a flow path including a flow chamber containing a body of adsorbent, and having an inlet for regeneration gas and an outlet for regeneration gas separated by a flow path including said flow chamber, said inlet for said gas mixture and said outlet for purified gas optionally constituting also said outlet for regeneration gas and said inlet for regeneration gas, said inlet for regeneration gas having an inlet nozzle containing at least one heater element, wherein said body of adsorbent has a first end which is adjacent said inlet for regeneration gas

and a second end which is remote from said inlet for regeneration gas, and the or each heater element is located so as not to penetrate through said first end of the body of adsorbent, so that said gas mixture is purified by the adsorption of at least one component and after a period stopping said flow of the gas mixture into said vessel, and

in a regeneration phase, passing regeneration gas into said vessel through said inlet for regeneration gas in the same or in an opposite flow direction whilst heating said regeneration gas by said heater element for a period, stopping said flow of the regeneration gas and resuming said flow of the gas mixture.

8. A method as claimed in Claim 7, wherein said heating is continued in the regeneration phase for a period not exceeding 90 minutes.

9. A method as claimed in claim 8, wherein the heating is continued in the regeneration phase for a period not exceeding 60 minutes.

10. A method as claimed in Claim 8, wherein said heating is continued for a period not exceeding 30 minutes.

11. A method as claimed in Claim 7, wherein the distance between the heater element or elements and the adsorbent is such that the transit time between the most downstream point of the heater element or elements and the adsorbent is no more than 4 minutes.

12. A method as claimed in Claim 7, wherein upon initiating a constant rate of heating of the regeneration gas, the regeneration gas immediately upstream of the adsorbent reaches an essentially steady state temperature within no more than 1 minute.

13. A method as claimed in Claim 7, wherein the gas is air and the components removed by adsorption comprise water and carbon dioxide.

14. A method of air separation by cryogenic distillation to produce an oxygen rich gas and a nitrogen rich gas, comprising a pre-purification of the air to remove at least carbon dioxide and water which is conducted by a swing adsorption method as claimed in Claim 7.